COLORADO ANATIDAE.

BY W. H. BERGTOLD.

THERE seems little ground on which to doubt the assumption that ducks, geese, and swans are gradually diminishing throughout the United States; the major part of this decrease is probably brought about by loss of feeding and breeding grounds, a loss incidental to reclamation of swamp and other similar areas, while of course the erstwhile and continuing wholesale destruction of these birds by shooting especially during mating, breeding and moulting seasons is a good second.

The ever onward advance of civilization is bound to continue the first; it is to be hoped that vigorous education as to the value of these birds, and wider spread Federal and State restrictions of shooting will mitigate the second and in part counteract the first.

The average duck hunter seems to care little for the shooting of the future, his efforts being focussed on his present sport and consequently efforts relating to preservation, etc., are lost on him. However there is a respectable moiety which is open to conviction by well supported data as to the decrease of species and the beneficial results, from his point of view, of shooting restrictions; these shooters can be convinced that wise control of shooting will not only save their "sport" but even increase it. Hence it is obvious that all facts relating to these disappearing species, and the causes of their diminution should be collected before they are lost or before it is too late, and especially when such facts might be profitably and convincingly used and published, and thereby the aid of such shooters be secured. These considerations impel me to present for study and preservation in published form a mass of invaluable data recently placed in my hands through the courtesy of Mr. Victor Kennicott of Denver, Colorado.

The data give exceptional definition to one's conception of Colorado Anatidae, and too, will be priceless for those who will have to grapple, in the future, with the question of shooting restrictions, as well as those who in the years to come will be interested

in the scientific aspects of a study of our water birds. The data cover all the mergansers, ducks, geese, and swans shot at the Kennicott Duck Club during a period extending from 1899 to 1922 inclusive (excluding 1914, 1915, 1919, 1920, and 1921, during which years no records were kept), and thus give the results of nineteen years' shooting.

Each year's shooting has been recorded with remarkable accuracy, minuteness and care, the records showing the dates of all "shoots," the names of the several different species brought in and the exact number of each kind shot. The records also embody many references to weather conditions, and many estimates of the numbers of the various species seen on the Club lake from time to time. The majority of the club members are thoroughly familiar with all the common ducks and geese, know some of the rarer species, and always save for identification, at the hands of some competent ornithologist, such birds as they do not recognize.

All of which goes to make these data especially reliable as a base on which to rest tentative conclusions regarding this avian family, as some of its members occur about the Club area, and possibly also for the eastern slope of Colorado.

When this study was undertaken it was hoped that similar records might be secured from the many other duck clubs licensed in this State. This hope was not realized as a considerable correspondence with the officials of many of these clubs showed that none kept a record of sufficient definiteness and accuracy to be of any use in the present survey.

I am given to understand that a few duck clubs of the United States keep unexcelled records, yet on the other hand diligent inquiry has shown me that only the briefest, if any, accounts are preserved by the vast majority of such clubs. This is greatly to be regretted as a detailed account of all the Anatidae collected by these clubs would give a cross-section of the country's Anatine birds to be secured in no other way, and would be of immense value to present and future investigators.

The Kennicott Duck Club's chief lake is part of an irrigation system supplying water to prairie ranches east of Longmont, Colorado, and forms one of the chain of lakes and reservoirs of this system. This lake is at an altitude of almost exactly five

thousand feet, is on the open plains about ten miles east of the foothills of the Rocky Mountains and has an approximate area of 600 acres.

It is probable that the records of this "station" reflect tolerably accurately the Anatine incidence, abundance, and migration of the eastern half of Colorado from the Wyoming to the New Mexico borders; this is however open to debate because the club's records show that many times there were hundreds of ducks on the lake and in the air, with no corresponding abundance in the bags. It is impossible to demonstrate that the birds killed mirror exactly the total numbers and kinds visiting the area, but these records do give us something more tangible than an ocular estimate, and are less open to doubt. I am told that at some eastern duck clubs a shooter often permits certain species to escape, trying meanwhile to get his "limit" amongst the large ducks. This results in a species of shooting selection which militates against such a club's records giving a correct picture of the local relative abundance of different species. I am sure that this selective shooting has prevailed very little, if at all, at the Kennicott Club.

However an effort to estimate the value of the records of this club as indices of the abundance of ducks on the eastern slope of Colorado may well be taken up here and I am by no means convinced that they are more than approximate reflections of the numbers of various ducks migrating over this portion of the State. The club records give more than a detailed statistical account of the weekly shoots, the record book is replete with notes as to weather, the number (estimated) and kinds of ducks on the lake, and cognate facts. A brief review of some of these notations may shed some light on the relation between the number of ducks killed and of those on the lake as determined by visual examination. It is self evident that an ocular estimate of a large flock of ducks is more or less guess work; on the other hand it is startling to witness the accuracy with which a cowboy can estimate the size of a herd of cattle, or a shepherd the size of a flock of sheep. By the same token an experienced duck hunter may be able to form an idea of the number of ducks on a lake, and be approximately correct. This is of course more true of small bunches than of large rafts of ducks.

On September 10, 1910, it was recorded that "several thousand blue-wing teal (came) in from the north." The shooting lists showed that 43 per cent of the day's bags were Blue-winged Teal. On October 21 of the same year it was recorded that there were "thousands of canvasback and gadwall ducks" on the lake, yet only three per cent of the ducks killed were Canvasbacks, and not more than eight per cent Gadwalls. The shoot of September 2 would lend support to the belief that the number of ducks killed was a correct index of the number of ducks on the lake, the shoot of October 21 distinctly fails to do so. Continuing this review it may be said that on November 25, 1900, there were "thousands" of ducks on the lake "mostly widgeons and mallards" and in correspondence with this statement there were 44 per cent Widgeons and 21 per cent Mallards in the make up of the day's shooting. On March 24, 1901, it was written that "two or three thousand on the lake [were] redheads, canvasbacks and pintails;" the percentages of these three species amongst the birds killed in the day's shooting were respectively 30 per cent, 4 per cent, and 35 per cent. Thousands of ducks "of all kinds" were on the lake October 20 of the same year and the shooting results seemingly bore out the correctness of this estimate, since the following percentages of species were then recorded, Green-winged Teal 57 per cent, Pintail 15 per cent, Widgeon 15 per cent, and Mallard 7 per cent. It was stated on March 1, 1908 that "2500 pintails (were) on the lake," implying I take it that this was the prevailing species; this species made up 33 per cent of the ducks killed that day. Finally on March 17, 1909 "four swans and 60 geese" were detected on the lake, yet the records show none of these birds shot. These quotations might be extended to greater length and in more detail but seem sufficient to serve as examples.

I am of the opinion, after a careful study of all the notations, and of the number of ducks killed from time to time that the Club's records form a reasonably reliable index of the abundance of our ducks as they migrate to and fro in the State. It is now impossible to evaluate the factors of skill of shooters, shyness of birds, deliberation in letting certain species escape, and the many others which might dislocate the relation of the numbers of birds killed to the numbers of those frequenting the lake during the shooting season.

One can say, at least, that estimates made on birds killed have a more substantial foundation than those based on ocular impressions.

The common idea of the aridity of our western states leads to the belief that in them there are relatively few ducks and geese; this was probably never true, and it is even less so now, for all the states given to irrigation are covered, so to speak, with a multitude of reservoirs which in the course of a few years have become the resting and feeding (and at times the breeding) grounds of thousands of water birds.

There are about fifty-seven different species and subspecies of the Anatidae which are found in North America north of Mexico, and of these thirty-eight have been taken in Colorado. Twenty-four of these have been shot at the Kennicott Duck Club, showing that the Club's list covers a large proportion of the State list, which includes approximately 65 per cent of the ducks occurring north of Mexico. The records of this Club therefore cover nearly 50 per cent of all North American Anatidae found, from our southern border, northward. It is highly probable that several Anatidae not included in the Kennicott list have been shot at the station, but passed unrecognized. I am convinced, for example, that both Scaups have been shot there, though only the Lesser is listed because both the Greater and Lesser Scaups would be called merely "bluebills."

The following table is a list of all the Anatidae definitely known to occur, or to have occurred in Colorado, those marked with an asterisk having been shot at the Kennicott station.

TABLE NO. 1

American Merganser*	American Golden-eye
Red-breasted Merganser*	Barrow's Golden-eye*
Hooded Merganser*	Bufflehead*
Mallard*	Old Squaw*
Black Duck	Harlequin
Mottled Duck	American Scoter
Gadwall*	White-winged Scoter*
Baldpate*	Surf Scoter
Green-winged Teal*	Ruddy Duck*
Blue-winged Teal*	Lesser Snow Goose*
Cinnamon Teal*	Greater Snow Goose

TABLE NO. 1 (*Cont.*)

Shoveller*	Ross's Snow Goose
Pintail*	White-fronted Goose
Wood Duck	Canada Goose*
Readhead*	Hutchins' Goose*
Canvasback*	Cackling Goose
Greater Scaup Duck	Brant
Lesser Scaup Duck*	Whistling Swan*
Ringneck*	Trumpeter Swan

The following list shows the status in Colorado of those ducks, etc., which have not been taken at the Kennicott station:

TABLE NO. 2

Black Duck; perhaps two State records.
Mottled Duck; one State record.
Wood Duck; always rare; no new record for years.
Greater Scaup; rare.
American Goldeneye; its actual occurrence in Colorado questionable.
Harlequin Duck; very infrequent.
American Scoter; rare winter visitor.
Surf Scoter; rare straggler.
Greater Snow Goose; perhaps three State records.
Ross's Snow Goose; perhaps two State records.
White-fronted Goose; straggler.
Cackling Goose; one State record.
Brant; one dubious State record.
Trumpeter Swan; perhaps three State records.

It is apparent from the above that the Anatidae missing in the Kennicott records are all extremely uncommon or rare throughout the whole State under any circumstances, a fact making it more apparent that the list of this Club is highly representative of the usual, and of some of the more uncommon Colorado Anatidae.

The following table gives the statistical data compiled from the Club records. Both spring and fall shoots are enumerated, until 1912, when spring shooting was prohibited by Federal law.

The table on page 78 is published in extenso in the belief that it will be useful and valuable to future students of North American Anatidae, who doubtless will then have access to records kept in the interim by shooting clubs throughout all of our country. The caption "miscellaneous" of this table embraces eleven different species taken at one time or another during the years of record;

TABLE NO. 3

		1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1916	1917	1918	1922	Total
1	Redhead	18	216	225	245	311	247	75	133	48	71	98	48	58	38	33	38	12	12	20	1946
2	Green-winged Teal	479	1007	739	843	684	681	532	145	899	437	153	391	217	429	423	111	61	78	199	8508
3	Pintail	19	144	176	332	148	204	103	153	21	76	34	40	18	43	39	32	7	7	142	1738
4	Gadwall	68	153	188	70	91	143	111	66	103	116	76	49	45	30	38	25	15	0	32	1419
5	Widgeon	85	341	190	266	308	116	65	39	64	50	24	34	9	27	25	13	2	3	28	1689
6	Bluebill	11	13	31	24	77	30	81	74	33	30	50	53	79	17	10	8	15	7	22	665
7	Mallard	73	170	134	336	300	534	298	313	312	290	141	250	144	257	141	77	4	3	310	4087
8	Canvasback	17	56	41	88	191	60	59	20	9	26	25	5	24	13	13	16	5	12	35	715
9	Ruddy Duck	42	31	1	12	85	60	131	165	141	309	183	110	62	49	46	278	187	233	489	2614
10	Shoveller	75	99	78	87	87	455	111	43	50	146	52	50	34	51	0	71	41	4	38	1572
11	Barrow's Golden-eye	5	6	6	17	19	30	25	31	81	18	5	33	13	4	0	13	0	1	20	327
12	Butterball	8	4	5	2	12	18	15	14	14	58	1	20	0	4	0	4	0	0	6	185
13	Blue-winged Teal	95	222	43	121	29	134	191	66	53	145	70	23	23	88	0	0	0	0	35	1338
14	Miscellaneous	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	133
	Total	995	2462	1857	2443	2342	2712	1797	1262	1828	1772	912	1106	726	1050	768	686	349	360	1376	26936

these species and the total number of each shot during nineteen years are as follows:—

TABLE NO. 4

American Merganser 68	White-winged Scoter 4
Hooded Merganser 3	Snow Goose (Lesser?) 1
Red-breasted Merganser 1	Canada Goose 11
Cinnamon Teal 10	Hutchins' Goose 6
Ring-necked Duck 22	Swan (Whistling ?) 1
Old Squaw 6	

Approximately 27000 individual ducks are now available for study; less than 1 per cent of this number are distributed amongst eleven species (see Table No. 4), and more than 99 per cent amongst the remaining thirteen species.

By estimating the percentages of every species we are able to construct Table No. 5 which follows:

Through the courtesy of Mr. F. G. Bonfils of Denver, Colorado, a member of the Bear River Duck Club (Utah) I am able to incorporate in this table, for purposes of comparison only, the number and kinds of ducks killed at that Club in the fall of 1922; in this table are also to be found data on breeding ducks of the Bear River area published by Wetmore in 'Bulletin 936,' U. S. Department of Agriculture. The percentages given in this table are accurate only to the decimal point.

TABLE NO. 5

[illegible]ince	Kennicott Club		Bear River Club			
	By Shooting		By Shooting		By Breeding	
1. Green-winged Teal	8508	31.5	3603	32.4	100	1.4
2. Mallard	4087	15.2	1066	9.7	600	8.2
3. Ruddy	2614	9.7			350	4.8
4. Redhead	1946	7.2	117	1.0	3450	47.3
5. Pintail	1738	6.5	2792	25.2	260	3.6
6. Widgeon	1689	6.3	549	5.0	20	0.4
7. Shoveller	1572	5.9	2227	20.2	500	6.8
8. Gadwall	1419	5.3	405	3.7	400	5.5
9. Blue-winged Teal	1338	5.0			20	0.4
10. Canvasback	715	2.6	196	1.7		
11. Bluebill	665	2.5	63	0.5		
12. Golden-eye	327	1.2	14	0.1		
13. Butterball	185	0.7	17	0.3		
14. Cinnamon Teal					1600	22.0
15. Miscellaneous	133	0.5				
Total	26936		11039		7300	

The ideas and conclusions that appear in the following pages are, it must be kept in mind, based entirely on the records of a single shooting station and they might be altered, negatived or upheld by records secured elsewhere in Colorado. It is not believed or held that they constitute the last word on Colorado Anatidae.

It is held by all of our local duck hunters that the Green-winged Teal is our most abundant duck, though it is often remarked that there is little difference, numerically, between it and the Mallard, an idea quite emphatically contradicted by the figures exhibited in Table No. 5, in which it appears that the Mallard is only half as numerous as the Green-winged Teal at the Kennicott station.

Subject to occasional fluctuations there has been a more or less steady decrease during the past twenty-four years in the total number of ducks yearly killed at this station. This decrease was not due to the war since it began in 1909 and we can grasp the extent of the decrease more easily when it is said that in the period from 1899 to 1908 (inclusive) there was but one year in which the shoot fell below one thousand, while from 1909 to 1922 (inclusive) there was only one year in which the shoot was above one thousand.

The cause of this decrease has been a source of much discussion amongst local duck hunters. It is believed by many that the lakes located close to the mountains have been gradually abandoned by the migrating birds, which, it is held, have tended to visit and congregate on the lakes situated farther to the east out on the plains; others think that periods of high or low water alter the number of ducks killed, an explanation hardly tenable s[redacted] the water height has merely fluctuated while the duck decrease has been more or less steady; the smaller number of ducks shot is not accounted for by the absence of those formerly shot in the spring, because the decrease was well under way before spring shooting ceased. It is also held that in previous years there were fewer lakes and reservoirs and thus the ducks were more concentrated. Many, moreover, believe that the present duck shooter is not so expert as his predecessors. These explanations do not seem susceptible of either proof or disproof. It may be that the decrease is not actually so large as it seems, an idea engendered by reading the notes of this Club, notes giving visual estimates of the birds

on the lake. It may be that the more recent generations of ducks are wiser and more "gun shy." There is, however, one indubitable factor in explaining a decrease of at least some ducks on this particular lake, and that is the absence of suitable food, which formerly fairly abundant, has almost entirely disappeared since the introduction and multiplication of carp in the lake. A lack of interest in the shooting during part of the World War may also be a factor in the causes of the smaller number of ducks shot during that time.

I am inclined to believe that no single cause can be held accountable for the decrease, actual or apparent, of ducks at the station; though two seem quite reasonable, the decrease of food and fewer expert shots.

It was anticipated and hoped that these data would throw light on the effect of prohibiting spring shooting. Spring shooting was never at this station so intense or persistent as in the fall, hence the records for birds killed in the spring are not large. An examination of the records does not, it seems to me, show whether or not spring shooting was detrimental to the natural increase of ducks. From the cessation of spring shooting in 1912 to 1922 the Club records are available for 1913, 1916, 1917 and 1922 only, making a period of but four years from which one can compare the fall shoots unaffected by previous spring shoots. This number of years obviously is too small to be useful in throwing light on this particular question. One may well ask, however, if the noticeable increase of ducks in 1922 might have been due to the accumulated effect of ten years' prohibition of spring shooting? There is a yearly fluctuation in the actual and proportional numbers of each species demonstrable by the shooting records; thus of all the Canvasbacks shot in nineteen years 27 per cent were taken in 1903, 20 per cent of all Widgeons in 1900, 19 per cent of all Ruddies in 1907, and 31 per cent of all Butterballs in 1908. Forty-seven per cent of the total shoot (all species) in 1907 were Green-winged Teal, 60 per cent of the 1917 shoot were Ruddies, and in 1922, 26 per cent were Mallards. The largest shoots of two or more species do not occur in the same year; the year of the greatest Mallard shoot being 1904, while that of the Green-winged Teal was 1900. There is a marked difference in the ratio between two given species from year to year;

in 1899 48 per cent of all ducks shot were Green-winged Teal, and only 4 per cent were Ruddies, while in 1917 the Green-winged Teal made 20 per cent of the year's shoot and the Ruddy 60 per cent. A large shoot in a given year does not necessarily thereby increase the number of any given species; in 1902 the total shoot was 2444, which included eighty-eight Canvasbacks, while in 1903 the total was smaller (2344) but then there were double the number of Canvasbacks as compared with 1902.

The records of this Club have enabled me to form a new conception of the relative abundance of Colorado ducks, a definite picture such as I never before had.

For the sake of convenience, judging by the records of the Kennicott Club it may be said tentatively that Colorado Anatidae fall into the following divisions:—

Abundant:

Green-winged Teal Mallard 15 to 30%

Common:

Ruddy, Redhead, Pintail, Widgeon, Shoveller, Gadwall, Blue-winged Teal — 5 to 9%

Uncommon:

Bluebill, Barrow's Golden-eye, Butterball, Canvasback — 1 to 2.5%

Infrequent, rare, or straggler:

All of the species listed in Table No. 2 plus the fourteen Colorado species never shot at this Club: 0.5%.

The Green-winged Teal, Mallard and Ruddy together contribute 55 per cent of all the ducks shot at this station from 1899 to 1923.

I regret that time did not permit investigating the relation between weather conditions in the fall and the dates of first arrivals, and of large flights. There is a decided difference in the reaction to weather conditions amongst several species appearing at the Club lake, and also seemingly a difference in different seasons. Thus the Mallard will remain at the lake as long as there is open

water, whatever the weather conditions may be. Then too there seems less connection between storms and the arrival of ducks in the spring, at which time they appear just as soon as there is open water, regardless of other conditions. The ducks even seem then to leave for the north despite local storms; it is recorded that on April 14, 1901, it was snowing but the ducks had left during the previous twenty-four hours, and on April 5, 1904, it was cloudy and stormy, yet the birds had departed the night before. Geese are apt to stop on the lake during a spell of stormy weather, a fact substantiated several times by the Club notes. There is abundant testimony in the records that large flights suddenly appear as heralds of, or passengers in, a severe storm; nevertheless there are also many statements showing that thousands of ducks come in, and also leave during fine weather. This is especially true of the common Teals, in late September and early October.

The relation of Anatine migration to meteorologic conditions is obviously a complex one and for a full elucidation there must be in hand data gathered from several different fields; mere local data do not suffice. It seems to me that one of the most promising leads would be the collection of Anatine migration data from the duck clubs of our country, to be studied in conjunction with information concerning continental and local weather conditions. The latter is already more or less in hand, and readily accessible to one with time for such research, while some well directed and persistent missionary work with officials of the duck clubs would in a few years more than supply the material to satisfy the first of these requirements.

The following remarks relating to particular species are based on the Club's records and embody conclusions which have been reached through a study of the nineteen years' shooting and observations; to these conclusions and remarks are added comments which seem pertinent in the premises.

Assuming that the birds killed at this station were migrating it will be of interest, and perhaps value, to compare statements on Anatine migration and abundance made in Cooke's fundamental publications on Colorado Birds (1897 et seq.), with the results of a study of the Kennicott records and the data given in Table No. 5 relating to the Bear River Duck Club.

Lophodytes cucullatus. HOODED MERGANSER. **Mergus serrator.** RED-BREASTED MERGANSER.—These are amongst the rarest of all ducks found at the Kennicott station. This statement holds true for the nineteen years shooting record; nevertheless in 1897 Cooke qualified them both as being perhaps not uncommon. It is possible that both species have become more infrequent since that date. On the other hand his correspondents on whom he relied for data, having been scattered all over Colorado, might have collected a wider range of information which would have given a correct evaluation for that time of the frequency of these two species, an evaluation perhaps of more worth than one coming from a single location. However the long continued and careful recording made by this Club might counterbalance such a disadvantage and would seem to be worth great weight in reckoning the abundance of the two species we are now considering. Again it is to be said that it is greatly to be regretted that the numerous duck clubs of Colorado have not kept careful records of their shoots. Such records would be invaluable and would help to place beyond cavil any questions as to the abundance of any species, and similar problems.

Mergus americanus. MERGANSER.—Far more common than its two cousins, forming 0.25 per cent of all ducks shot during the record period. It is quite probable the actual incidence is greater than these figures indicate for I am of the opinion that the Shelldrake is frequently recognized by the experienced shooter and deliberately permitted to escape, its well known inedible qualities carrying with them safety for the bird. I should say that it is now about as abundant as at the time Cooke said it was "not uncommon."

Anas platyrhynchos. MALLARD.—This splendid duck forms more than 15 per cent of the nineteen years shoot; it reaches its spring maximum at the Club during the last week of March and the first week of April, and in the fall it has a continuous maximum, so to speak, from the second week in November onward all winter, or until the lake is frozen over. It has, in nineteen years, stood first once in abundance in a year's shoot, while it stands second as the commonest duck for the entire period just mentioned. It frequently lingers all winter in enormous numbers whenever there is open water in the Club lake, just as it does at many other suitable localities in the State. It must be just as hardy as any so called "sea duck," judging by its indifference, in Colorado, to cold, storm, and freezing conditions. A scrutiny of the notes embodied in the Club records also casts an interesting side light on the abundance of the Mallard at this station. On November 1, 1904, it was noted that there were "ten thousand ducks on lake, mostly mallards," and this condition as to numbers and species is again recorded a week later. One must again admit that a visual estimate of the number of ducks on a lake is rather a shaky foundation on which to base a statement of a species' abundance, yet any old duck hunter knows how occasionally ducks are present beyond counting, in myriads as it were. There

is no doubt in my mind but that the number of Mallards killed in nineteen years form but a small fraction of those that actually visit the lake.

Chaulelasmus streperus. GADWALL.—This so called western species stands eighth in the scale of abundance, but varies much from year to year. In 1901 one hundred and eighty-eight were killed, and only forty-five in 1911 (the last year of spring shooting). This species reaches its maximum about the fourth week of October. It seems to me that Cooke's characterization of it as "common" is correct, only as Mergansers are concerned.

Mareca americana. WIDGEON.—This is another duck which varies greatly from year to year in abundance at this station; 20 per cent of all the Widgeons shot at this Club were taken in 1900. The bird reaches its maximum during the first week of November but at no time is it abundant, forming only about 6 per cent of the total shoot for nineteen years. By this club's data it is more common than the Shoveller, hence it cannot be said to be "tolerably common" if the latter be "common" (Cooke).

Nettion carolinense. GREEN-WINGED TEAL.—This is by far the most abundant duck of the State, it stands at the head of the Club's list making more than 31 per cent of all the ducks shot in the record period. It is probable that quite a few of these birds were raised in local Colorado breeding areas and in such southern areas as Salt Lake, but it is obvious from its great numbers that the bulk must come from northern breeding grounds. This duck has ranked first yearly for thirteen years at the Kennicott Club, it reaches its maximum in seasonal abundance during the second week of October, and once, in 1907, it formed as much as 47 per cent of all the ducks killed in a single year. It also is the most common duck killed at the Bear River Duck Club (Utah).

Its total at the Kennicott station for nineteen years was more than twice as large as the next most common species, a fact which gives one a good idea of its numbers in Colorado. There is, however, no such striking difference between the two most common species at Bear River as there is at the Kennicott Station.

Querquedula discors. BLUE-WINGED TEAL.—This species is often rated as a "common" species in Colorado, in fact one authority says in effect that it is as common as its close relative, the Green-winged Teal. As a fact the Blue-winged Teal forms only 5 per cent of the ducks killed at this station, and ranks ninth in abundance there. It is the first duck to come back in numbers in the fall, the peak of migration occurring earlier in Colorado than that of any other duck, to-wit, during the last week of September and the first week of October. It is evidently more common in Utah for it stands fifth in abundance on the Bear River list. This duck is, to all intents and purposes, absent in the spring at the Kennicott Club lake, as in only two springs out of nineteen are there records of its having been killed at the Kennicott lake.

Querquedula cyanoptera. CINNAMON TEAL.—In view of the fact that this species has been recorded as breeding somewhat commonly in

Colorado, I am unable to understand its rarity at the Kennicott Club, where but ten individuals were killed from 1899 to 1922. Of these ten four were taken in the fall of 1904 and three in 1907 and 1908, thus leaving but three for the remaining years of record. The Cinnamon Teal is next to the commonest breeding duck at the Bear River Club, where during 1914 and 1916, according to Wetmore,[1] approximately sixteen hundred of these birds were nesting. Notwithstanding this local summer abundance none are listed as having been killed at the Bear River Club during the shooting of 1922; this absence has been explained on the grounds that the Cinnamon Teal leaves Salt Lake before the fall shooting opens. It is possible that a similar condition obtains at the Kennicott Club. I have no further data or information which might shed light on this interesting problem.

Spatula clypeata. SHOVELLER.—The "Spoonbill" supplies about 5 per cent of the ducks shot at the station, it being what might be called a consistent visitor to the region, since the numbers shot each year range closely at about the same level. However, it, too, has years of extraordinary abundance. In 1904 four hundred and fifty were killed, these birds forming nearly 17 per cent of the whole shoot for that year. There were also in this year unusual flights of Green-winged Teal, and Mallards, which with the Spoonbill then totalled more than 60 per cent of the year's shoot.

The Shoveller is evidently more common during the shooting season at Bear River than at the Kennicott station for it is third in abundance at the former and seventh at the latter.

Dafila acuta tzitzihoa. PINTAIL.—This subspecies is one of five ducks which are all fairly close together in their average of abundance in eastern Colorado during migration. It makes up about 6 per cent of all the ducks killed at the Kennicott station, and there reaches the peak of its maximum numbers during the first week of October. It must be pretty evenly distributed over the western part of the United States since it stands seventh amongst the breeding ducks of Bear River, and is fifth of those killed at the Kennicott Club lake; it is however next to the commonest duck killed at Bear River, the Green-winged Teal only, ranking it there.

Marila americana. REDHEAD.—We must regard the Redhead as very unusual in its seasonal distribution along the eastern watershed of Colorado because on an average more than 60 per cent of the year's kill of this species occurs in the spring. It breeds sparingly in Colorado yet it is the most common of the ducks nesting at Bear River, the difference probably being caused by more extensive and favorable breeding and feeding areas at Bear River. The situation in these two areas is reversed, judging by the numbers shot, for the species stands fourth in the list of ducks killed in nineteen years at the Kennicott Club, and eighth amongst those killed in 1922 at Bear River. It would be of much interest were we to know the cause of the greater vernal abundance of the Redhead in Colorado. This spring preponderance was not brought about by one or two large

[1] Bulletin 936, U. S. Dept. Agriculture, p. 5.

spring flights sending the records up as the Redhead was more common in the fall than in the spring only four times during the whole record period. It is possible that in autumn the migration route splits, while in the spring nearly all the birds go northward, east of the mountains. In the spring it is most abundant during the second and fourth weeks of March, while in the fall there is only one peak, that is to say in the second week of October. About 7 per cent of all the ducks killed at this station since 1899 were Redheads. The species seems to be gradually growing less common on the Kennicott lake, if one can judge by the numbers killed each passing year.

Marila valisineria. CANVASBACK.—The Canvasback is a relatively uncommon duck at this station as on an average only thirty-five to forty are killed there each year; however, 191 were shot on the lake in 1903, a number which formed 27 per cent of all the Canvasbacks shot at the station during the period of record. This species stands tenth in abundance at the Kennicott Club, outranking the Bluebill by less than 1 per cent.

Marila affinis. LESSER SCAUP. BLUEBILL.—It is somewhat strange that the two ducks showing an abundance greater in the spring than in the fall should belong to the same genus.

The Lesser Scaup as well as the Redhead is more common in the spring than in the fall; from 1899 to 1911 (inclusive) 656 Bluebills were shot at the Kennicott station, of which 417 were taken in the spring. Expressed otherwise 63% of the thirteen years collection were from the spring shoots and only 37% from the fall. At best the Bluebill may be classed as an uncommon duck in Colorado, since it makes less than 3% of the ducks killed at the Kennicott station in the record period. Its spring maximum falls into the last week of March and the first week of April, while in the fall its greatest abundance is during the last week of October. The probability that some of the "Bluebills" are Greater Scaups has already been referred to.

Marila collaris. RINGNECK.—This duck is a rare one in Colorado, for in nineteen years only twenty-two were killed at the Club lake; the fact that in 1904 eight were shot, and in 1909 eight more, leaving but six which were recorded in the other seventeen years, gives a striking view of the Ringneck's rarity in Colorado, and also a good index of the irregularity of its visits to the area. The Ringneck is one of eleven species and subspecies which, collectively, make only 0.5 per cent of all the Anatidae shot at the Kennicott Club lake.

Glaucionetta islandica. BARROW'S GOLDEN-EYE.—The average duck shooter naturally does not distinguish between the American and the Barrow's Golden-eye, so in the absence of positive identification, and on geographical grounds, all Golden-eyes shot at this station have been taken as Barrow's Golden-eye. The extreme rarity of the American form also militates against assuming that any of the Kennicott Club Golden-eyes were of this subspecies. The Golden-eye is subject to wide annual fluctuations

in numbers; for example, 25 per cent of all the birds of this species shot during the Club's record period were taken in 1907. Judging by shooting records alone the species is about as uncommon in Utah as in Colorado, standing in Utah as eleventh and in Colorado as twelfth in abundance.

Charitonetta albeola. BUTTERBALL.—This handsome species is another of Colorado's rare ducks; the number shot in any one year has never been above twenty, except in 1908 when fifty were killed making 31 per cent of all the Butterballs shot at the station since the records began. At best it supplies less than 1 per cent of the ducks killed at the station, yet it is a regular visitor each fall, for in but two autumns of the nineteen has it failed to be listed as amongst the ducks brought in by the gunners. Moreover the total number shot in nineteen years exceeded by more than fifty the total number of all the eleven rare ducks combined, which fact is an added index of its distribution.

Clangula hyemalis. OLD-SQUAW.—It is held by many that the Old-wife is but a straggler in Colorado, nevertheless the number shot at this station during the record period equals 50 per cent of the Cinnamon Teal shot there. This forms a good scale by which to appreciate the rarity of this Teal at the Kennicott Club lake, especially when we realize that only six Old-squaws were collected at the station in nineteen years.

Oidemia deglandi. WHITE-WINGED SCOTER.—There can be no question as to the rarity of this Scoter in Colorado; a fact reinforced by the records of this Club, which show that only four individuals were shot there from 1899 to 1922 (inclusive).

Erismatura jamaicensis. RUDDY DUCK.—The incidence of this species at the Kennicott station is most interesting. For six years (1899 to 1904) the average annual collection was about forty. In 1905 there was an abrupt and decided increase, the yearly average for the following six years jumping to about one hundred and seventy-five, for the next three years the average annual shoot was again about fifty, and finally from 1916 to 1923 the number of Ruddies killed averaged each year about three hundred. It is evident that there has been a more or less steady increase of the Ruddy at this station for a number of years, and that laterally the increase has been very marked. The pre-war percentage of the Ruddy to all others was 5.9 while the post-war was 42. In casting about for an adequate explanation of this increase many have come up but none seems susceptible of proof. Some local gunners seem to think that the use of a motor boat on the lake tends to keep the Ruddies in the air resulting in more chances as they fly near the blinds. It is also possible that the continued diminution of many of the larger species has led to a gunner making a choice between killing the smaller Ruddy, or going home without getting any ducks.

Of the total of all Ruddies shot at this station in nineteen years about 20 per cent were shot in 1922, and 60 per cent of the total duck shoot of 1917 were Ruddies. This species has been the ranking one in numbers

killed for five years, displacing the Green-winged Teal in its supremacy of the previous thirteen years, but for the whole period of nineteen years the Ruddy ranks only as the third most abundant duck. If it continues to increase in the near future as it has in the recent past it will have to be classed with the Green-winged Teal and the Mallard as an abundant Colorado duck. The Ruddy reaches its maximum abundance at the Kennicott station during the second week of October.

Geese.—Eighteen Geese have been killed at this station during nineteen years, to-wit, eleven Canada (*Branta canadensis canadensis*), six Hutchins' (*Branta canadensis hutchinsi*), and one Snow Goose, presumably the Lesser (*Chen hyperboreus hyperboreus*). This number does not however correctly reflect the abundance of Geese in the area, for the annotations to the record show that many Geese were seen on the lake at various times but none secured. Such notes as these illustrate this point:—"Seventeen Geese on the lake" March 11th., 1900, and "more than 60 geese on the frozen lake" March 17, 1919. It is uncommon for these shy birds to pass so close to a blind that they are within gunshot, which helps to account for the small numbers shot. No Hutchins' Geese have been killed at this Club since 1901.

Swans.—The Kennicott Duck Club has on its list but one Swan since 1899, presumably a Whistling Swan (*Cygnus columbianus*); however "four swans" were seen on the lake ice on March 17, 1919.

1159 Race St., Denver, Colo.

AN EAGLE OBSERVATORY.

BY FRANCIS H. HERRICK.

Plates X—XII.

THE domestic life of the White-headed Eagle (*Haliæetus leucocephalus*) has never before been subjected to close scrutiny and accurate record, in spite of its wide distribution, its commanding appearance and its great notoriety. Although for upwards of one hundred and forty years the emblem of the courage, the power and the authority of a free and sovereign people, the national aegis has not always afforded it adequate protection: decried by some for the ignoble qualities which it too often displays, it has been ravished and persecuted on every hand: from the days of the Indian intrepid climbers have repeatedly reached its nest, if only to rob it of its eggs or young. It should be noted, however, that greater consideration has sometimes been shown when those young